Dec. 4, 1934. G. W. HART 1,982,955

THERMOSTATICALLY OPERATED ELECTRIC SWITCH

Filed Nov. 14, 1931 2 Sheets-Sheet 1

Fig. 1

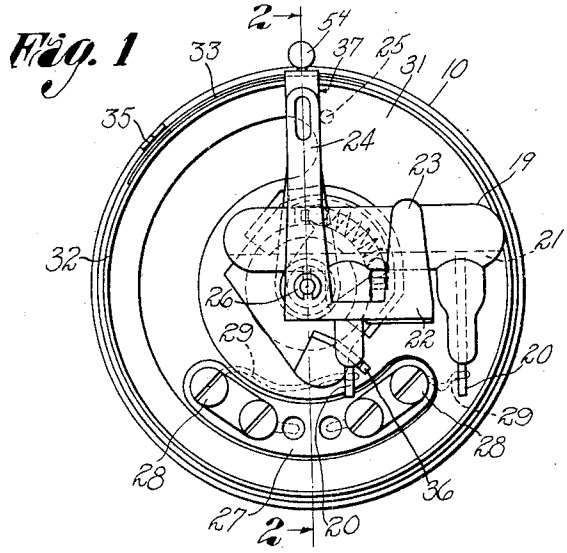

Fig. 2

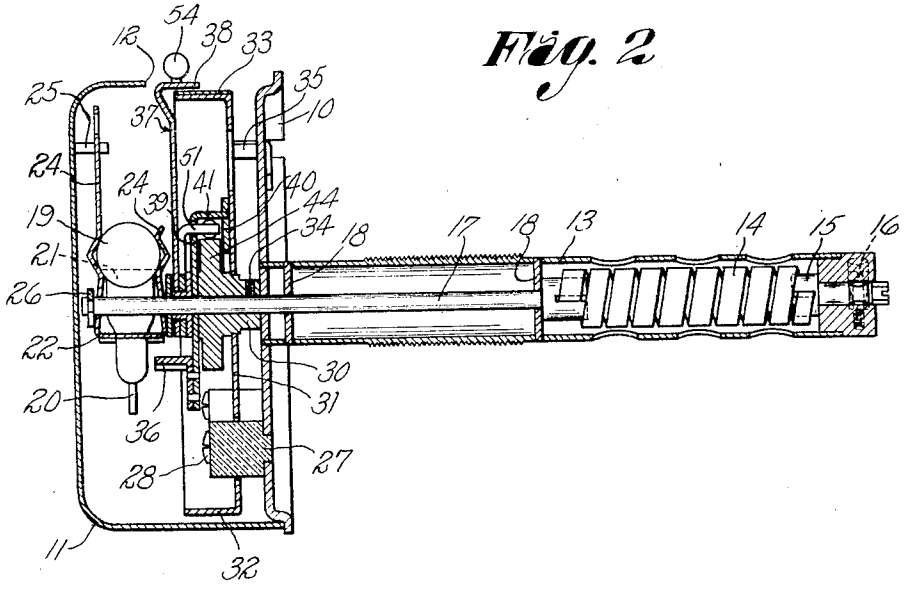

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Fig. 3

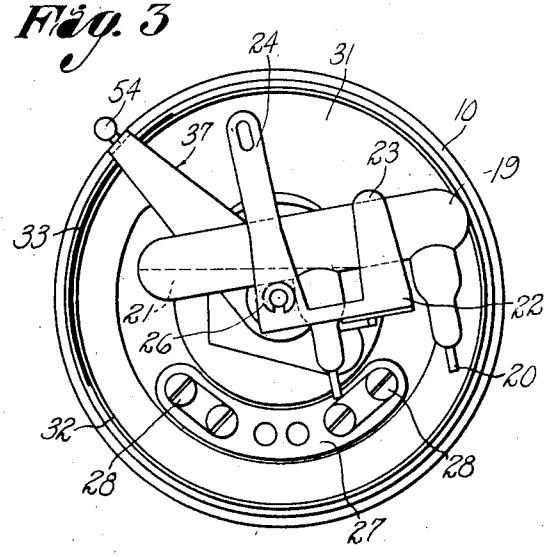


Fig. 5

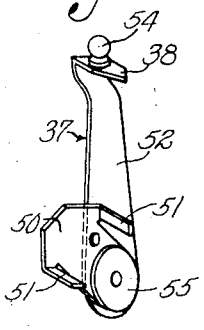


Fig. 4

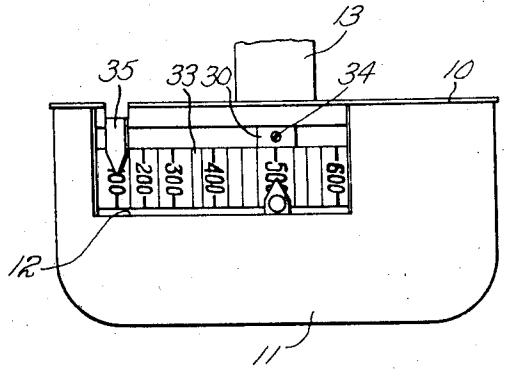
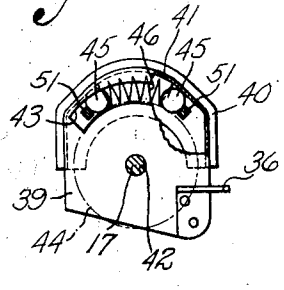


Fig. 6



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UNITED STATES PATENT OFFICE

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THERMOSTATICALLY OPERATED ELECTRIC SWITCH

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Application November 14, 1931, Serial No. 575,136

9 Claims. (Cl. 200—138)

This invention relates to thermostatically operated switches for use in controlling temperatures within a chamber or the like. As an instance of a use to which the device of the present invention may be applied, reference may be had to the controlling and indicating of the temperature of an electrically heated oven or the like, it being understood, however, that the improved apparatus is not limited to this specific application.

The aim of the present invention is to provide an improved device having a thermostatic element and a switch operated thereby, means for adjusting the device so that the thermostatic element will make and break the switch at any desired temperature within a given range of operation, and means for indicating, at all times, the temperature of the apparatus or chamber the heat of which is to be controlled; the setting means being adjustable at all times and irrespective of the temperature of the thermostatic element without straining or throwing any burden on that element or in any way disturbing the accuracy with which the device operates.

A further aim of the invention is to provide a device of this sort which may be easily and quickly adjusted to operate at any desired temperature and without resorting to the expedient of making compilations; and which is so arranged and constructed that the temperature of the chamber to be controlled and the setting of the device for operation at any given temperature may be clearly observed at all times.

A still further aim of the invention is to provide a thermostatically operated indicator and switch which is characterized by its simplicity in construction, its compactness in arrangement, and its effectiveness in operation.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawings, wherein is shown one of the embodiments which the present invention may take,

Fig. 1 is a front elevational view of the device with the cover removed;

Fig. 2 is a sectional view taken longitudinally and centrally through the device, this view being taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a view similar to Fig. 1 but showing the mercury switch tilted to a position where the current is broken;

Fig. 4 is a top view of the casing and shows the scale with which is associated two pointers;

Fig. 5 is a perspective view of the setting member; and

Fig. 6 is a front view of the clutch, parts being broken away for purposes of clearness.

Referring to the drawings in detail, the device is shown, for illustrative purposes, as having a casing provided with a back plate 10 and a removable cup-shaped cover or cap 11 provided in its cylindrical wall with an arcuate opening or window 12. Extending rearwardly from the back plate is a tube 13 the rear end of which is perforated. Within this tube is a thermostatic element 14 of any suitable kind or shape, the same here being shown as comprising a coil the rear end of which is connected to a rotatably adjustable plug 15 which may be secured in place by a screw 16. The forward end of the coil is connected to the rear end of a shaft 17 suitably journalled for rotary movement in partitions 18 and also in the back plate 10. The construction so far described is shown by way of illustration only.

The switch is operated by the thermostatic coil through the shaft 17, and is here shown as being of the well known mercury type which consists of a tube 19 having a pair of terminals or contacts 20 and a circuit closing member in the form of a body or globule or mercury 21. The mercury switch is carried by a holder 22, preferably formed of sheet metal and having two pairs of spring fingers 23 and 24 between which the tube is held. One of the fingers 24 is relatively long, and is adapted to engage against a stud 25 projecting rearwardly from the cover. In the present illustrated disclosure, the mercury switch is pivoted for relatively free rocking movement on, and relative to, the shaft 17. As shown in Fig. 2, the shaft extends through the opposite sides of the holder, and the holder is held against axial movement on the shaft by a split washer 26. The pivotal point of the mercury switch is off center, that is, it is located to one side of the center of mass of the switch and holder so that normally the tube, under the force of gravity, will assume the horizontal position shown in Fig. 1 and in which position the long finger 24 engages the stud 25. It is not essential that the axis about which the mercury switch rocks be coincident with the axis of the shaft 17, the present arrangement being disclosed by way of illustration only. The numeral 27 desig-

nates a suitable insulating block having posts 28 to which the contacts 20 are respectively connected by flexible wires 29, as is usual in switches of this type.

In accordance with the present invention, there is provided a graduated scale which is rocked or turned by the thermostatic element as the temperature of the latter changes; a stationary pointer associated with that scale for indicating the temperature within the chamber to be controlled; and means between the shaft 17 and the mercury switch through which the mercury switch is rocked by the thermostatic coil, this means being adjustable so as to vary the point at which the current is made and broken, and this means having a setting member cooperating with the scale for indicating on the scale at all times the temperature at which the device is set to operate. In the present illustrated disclosure, there is affixed to the shaft within the casing a hub or collar 30 to which is fixed a sheet metal disk 31 having a cylindrical skirt 32 on the periphery of which is mounted a scale 33, the latter having, as most clearly shown in Fig. 4, suitable graduations for indicating degrees of temperature. The member 30 may be adjustably fixed to the shaft by a set screw 34. The numeral 35 designates a stationary pointer which, in the present instance, is fixedly mounted on the back plate. This pointer extends over the scale 33 and indicates thereon the temperature at any time prevailing within the chamber to be controlled.

The means for operatively associating the shaft 17 with the switch includes an operating member which may be in the form of an arm or finger 36 which is adjustable relative to the shaft 17. The adjustable and disengageable connection between the operating member and the shaft is in the form of a ball clutch, and the adjustment may be effected by a setting lever 37 having a pointer 38 cooperating with the scale 33.

Referring more particularly to the illustrative embodiment shown in the drawings, the finger or arm 36 is fixed to, or carried by, a clutch member or cage having a front wall 39, a rear wall 40, and a peripheral wall 41. The front wall has an opening 42 through which the shaft 17 extends. The front wall also has an arcuate opening 43, the purpose of which will be hereinafter described. The hub member 30 has a disk portion 44, the edge of which is straddled by the front and rear walls of the cage. It will be seen from Fig. 6 that the disk or clutch member 44 is concentric to the axis of the shaft, while the peripheral wall 41 of the other clutch member is eccentric; in other words, there is provided between the disk and the peripheral wall 41 a space which gradually tapers down in height or radial distance to either side of a central point. Within this space are two spherical balls 45 between which is a compression spring 46 normally urging the balls apart. It will be understood that, when the balls are in the normal position shown in Fig. 6, the cage or driven clutch member having the operating element 36 will turn with the shaft 17 as that shaft is turned by the thermostatic coil and irrespective as to which direction the shaft is turned; that is to say, if the shaft is turned counterclockwise, referring to Fig. 6, the left-hand ball forms a driving connection between the disk 44 and the cage and, when the disk is rotated in the opposite direction, the right-hand ball serves as a driving connection.

For the purpose of disengaging the clutch and adjusting the driven clutch member having the operating member 36 relative to the driving disk 44, the setting member shown in Fig. 5 is provided. This setting member 37 includes a part 50 having two prongs 51; an arm 52 having a pointer 38 and a finger piece 54; and a flanged bushing 55 extending through the arm and part 50 and connecting the same together. The bushing 55 has a through opening which accommodates the shaft 17. The bushing is adapted to be turned relative to this shaft. The prongs 51 extend through the slot 43 in the cage and are adapted to respectively engage the balls 45. The pointer 38 extends over the scale 33.

The operation of the device will be clear from the foregoing description, taken in connection with the following brief explanation. The mercury switch, due to the fact that it is pivoted off center, will normally tend to assume the horizontal position shown in Fig. 1 where the long arm 24 engages the pin or stud 25 and the mercury closes the circuit between the terminals 20. To adjust the device so that the circuit will be broken at the desired temperature, it is merely necessary to move the setting lever 37 until the pointer 38 thereof is brought into registry with that indication mark of the scale corresponding to the desired temperature at which the device is to operate. If, in setting the lever, it is moved to the right, referring to the drawings, say from three hundred degrees to four hundred degrees as indicated by the scale, the left-hand prong 51 first moves the left-hand ball to the right and out of clutching position and then the right-hand prong comes into engagement with the right-hand end of the slot 43, whereupon the cage will be adjusted with respect to the disk 44. When the lever is set to the left, it is the right-hand prong which moves the right-hand ball from engaged position and the left-hand prong which engages the left-hand end of the slot 43. When the setting member is released, the spring 46 forces both of the balls to their normal positions so that each forms a driving connection between the disk 44 and the cage. It is, of course, obvious that, when the clutch member or cage is adjusted relative to the disk, the operating member or arm 36 is correspondingly adjusted and it is also adjusted with respect to the holder for the mercury switch. It is also important to note that the driving connection between the shaft and the operating member 36 may be adjusted at any time and irrespective of the temperature and condition of the coil, and the indicated setting of the operating member is not disturbed during the operation of the device because the scale 33 turns with the shaft 17, and the setting member also turns with that shaft during normal operation of the device. The fixed pointer 35 indicates on the scale 33 the temperature within the chamber to be controlled. Assuming that the device has been set to operate at five hundred degrees, the temperature of the oven or other chamber to be controlled rises, the shaft 17 and the clutch member 44 will be rotated counterclockwise and the disk will tend to crowd the left-hand ball 45 more tightly against the peripheral wall 41 of the cage and thus cause the cage to rotate with the disk in a counterclockwise direction, and the operating member 36 is slowly raised toward the bottom of the switch holder 22. When five hundred degrees temperature is reached, the operating arm will rock the switch to the position shown in Fig. 3 and in which position the current has been broken. The temperature of the chamber will now fall, and the thermostatic element

will turn the shaft in a clockwise direction with the result that the disk 44 will turn the cage through the right-hand ball 45 in a direction to lower the operating member 36, thus permitting the switch to assume its normal position shown in Fig. 1 and thus again make the circuit.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. In a thermostatically operated switch, a switch, thermostatic means, a scale adapted to be turned by said thermostatic means, an operating member between said thermostatic means and switch and adapted to be turned by said thermostatic means in unison with said scale, an adjustable clutch between said operating member and thermostatic means, and means for setting said operating member relative to said thermostatic means and having a pointer cooperating with said scale.

2. In a thermostatically operated switch, a switch comprising a pivoted mercury tube, thermostatic means, a scale associated with, so as to be rotated by, said thermostatic means, an operating member adapted to be turned by said thermostatic means and to engage said switch, an adjustable clutch between said operating member and thermostatic means whereby said operating member may be adjusted relative to said switch, and a pointer cooperating with said scale, adjustable with said operating member, and adapted to be turned in unison therewith by said thermostatic means.

3. In a thermostatically operated switch, a switch comprising a pivoted mercury tube, thermostatic means, a scale associated with, so as to be turned by, said thermostatic means, an operating member adapted to be turned by said thermostatic means and adjustable relative to said switch, adjustable clutch means between said operating member and thermostatic means, and a setting member for controlling said clutch means and having a pointer cooperating with said scale and adapted to be turned by said thermostatic means.

4. In a thermostatically operated switch, a switch comprising a pivoted mercury tube, thermostatic means, an operating member adapted to be turned by said thermostatic means and through which said thermostatic means is adapted to tilt said switch, a double acting adjustable clutch between said operating member and thermostatic means, and a pointer movable and adjustable with said operating member and cooperating with said scale.

5. In a thermostatically operated switch, a switch comprising a pivoted mercury tube, thermostatic means, a scale associated with, so as to be turned by, said thermostatic means, an arm adjustable relative to and adapted to engage said switch, an adjustable and operative connection between said arm and thermostatic means and including a double acting ball clutch, and a setting pointer for adjusting said clutch and cooperating with said scale.

6. In a thermostatically operated switch, a switch having a pivoted element, thermostatic means, a shaft adapted to be turned by said thermostatic means, a scale carried by said shaft so as to turn therewith, a fixed pointer cooperating with said scale, an operating member adapted to turn with said shaft and adjustable relative to said switch, an adjustable double acting clutch between said operating member and shaft, and a setting member adapted to turn with said shaft and adjustable relative thereto, said setting member having a pointer cooperating with said scale.

7. In a thermostatically operated switch, a switch comprising a pivoted mercury tube, thermostatic means, a shaft adapted to be turned by said thermostatic means, a scale carried by said shaft, a fixed pointer cooperating with said scale, an arm adapted to turn with said shaft and adjustable relative to said switch; a clutch between said arm and shaft and including a driving clutch member fixed to the shaft, a driven clutch member to which said arm is fixed, and a pair of balls between said clutch members, one of said balls constituting a driving connection when the shaft is turned in one direction and the other of said balls constituting a driving connection when the shaft is turned in the opposite direction, and a setting member normally turnable with said shaft and having a pointer cooperating with said scale, said setting member having fingers respectfully cooperating with said balls for moving the same from engaged position when the setting member is turned relative to the shaft.

8. In a thermostatically operated switch, a switch, a thermostatic element, a scale operable by the element, a switch closer, adjustable connecting means between the scale and the switch closer for operating the latter at a predetermined time to close the switch, and an adjusting device adjustably associated with said scale to move therewith and disposed for engagement with said connecting means for adjusting the same for operation relatively to the scale.

9. In a thermostatically operated switch, a switch, a thermostatic element, a shaft connected to the element to be turned thereby, a scale fixed to the shaft, a driving element carried by the scale, a second driving element having a switch closer thereon in the path of the switch, adjustable connecting means between the driving elements, and an adjusting device for the connecting means adjustably mounted on the shaft and movable therewith and having a pointer cooperative with the scale for determining the temperature at which said connecting means may operate.

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